Cant Indicator for Firearms

Cross-References to Related Applications

Not applicable.

Statement Regarding Federally Sponsored Research or Development

Not applicable.

Background of the Invention

[0001] The invention relates to an indicator device an indicator and an inclination sensor that is calibrated with respect to a vertical axis and with which a vertical plane is associated, and the inclination sensor senses a deflection of the vertical plane with respect to the vertical axis and a system consisting of a firearm. The invention also relates to a telescopic sight where the module can be fastened to the eyepiece of the telescopic sight by the fastening device.

Technical Field

[0002] For a modern equipped precision firearm, under optimum environmental conditions, the target point aimed at can be attained at target ranges of up to 1,200 meters with a hit accuracy of 40 cm with a .338 caliber.

[0003] Besides the unavoidable error factors such as thermals or changing wind directions within the flight path of the shot, weapon cant is an important possible source of error. Thus, for example, a cant of 3° at a target range of 600 meters, with a bullet drop of 3 meters, results in a hit deviation of 16 cm. An alignment of the weapon with the aid of the cross hairs and orientation aids in the place of use, such as edges of buildings and lampposts, is not always possible. Particularly for use in impassable terrain such as mountains, the required orientation aids for alignment of the weapon are not available.

[0004] From German Patent Document DE 22 59 913, a telescopic sight is known, with a construction by means of which hit deviations due to system cant and air pressure effects can be mechanically compensated. In this system, optical elements of the telescopic sight are displaced for compensating the cant. Thus the inverting system contained in the telescopic sight is mounted by means of a spring, so that the inverting system is deflected with respect to the telescopic sight by the effect of the spring in dependence on a cant.

[0005] Such a mechanical compensation is connected with a high mechanical expense. Furthermore, such a construction has the risk of destabilizing the target line, since optical elements for imaging the target line are not mounted with axial stability.

[0006] From German Patent Document DE 34 01 855 A1, an auxiliary aiming device for firearms is known. This auxiliary aiming device consists of an inclinometer associated with the sighting device for monitoring the cant angle of the firearm. The inclinometer consists of a closed profile tube ring of transparent material, which is about half filled with a liquid. The ends of the liquid column are associated with a marking, so that a cant of the weapon can be read off from the liquid level in relation to the marking. In this design of an inclinometer, it is disadvantageous that the viscosity of the liquid changes in dependence on temperature, and thus the accuracy of indication depends upon the temperature, which is undesirable.

[0007] From Swiss Patent Document CH 48379, a panoramic leveling telescope for firearms is known. In this panoramic leveling telescope, a spirit level is attached to the eyepiece housing with its axis running perpendicular to the eyepiece axis.

[0008] From the Anschütz company, a sight is known under the designation "Universal Sight 7002/20", as advertised in the Kettner 2002 hunting catalog on page 114, and can be pivoted for compensating cant.

[0009] Furthermore, telescopic sights are known in which a spirit level is integrated as an alignment aid into one image plane. This however has the disadvantage that parallax is always present for imaging, and that the spirit level is often poorly visible. Besides this, the functionality is restricted when shock and temperature fluctuations occur.

Summary of the Invention

[0010] The object of the invention is to provide a system that can be universally used and is cost-effective.

[0011] Another object of the invention is to provide a device making it possible for a marksman to exactly align the firearm, even in impassable terrain.

[0012] The object of the invention was attained by the following features: an indicator and an inclination sensor that is calibrated with respect to a vertical axis and with which a vertical plane is associated, and the inclination sensor senses a deflection of the vertical plane with respect to the vertical axis, which includes a module that is formed by an indicator device and is provided with a fastening device for mounting on a system consisting of a firearm and a telescopic sight. By the measure of forming the indicator device as a module that can be attached by means of a fastening device to a system consisting of a firearm and telescopic sight, it is possible to retrofit such a system with an indicating unit for the indication of a cant. Such an indicator device can also be used with different telescopic sights. Furthermore it is thereby possible not to basically have to equip all the telescopic sights of a series with the same kind of indicator device in order to be able to offer this convenience to a potential customer. Consequently the development of the indicator device and of new telescopic sights can proceed separately from each other, which also has a positive effect on the development costs. Furthermore, the indicator device that includes a separate item or equipment,

and a series with low numbers of product, which do or do not have a cant indicator, are avoided.

[0013] Furthermore, the possibility is also provided to send an indicating device that has a defect for repair, and to continue to use the telescopic sight or the system of firearm and telescopic sight. Also, a quick change is at comparatively little cost, since the telescopic sight does not also have to be changed as well.

[0014] Since the indicator has at least one lighting element, it can be ensured that a cant can be clearly indicated to the marksman even in conditions of poor visibility. It can also be provided that a lighting element is provided for lighting the indicator, so that the lighting element itself does not serve to indicate a cant.

[0015] The more precisely the alignment of the weapon is made possible, the more precise certainty of a hit can be ensured, even at great ranges.

[0016] Since a cant of the weapon is indicated to the marksman by this indicator device, the marksman can himself correct the alignment of the weapon, and the optics of the telescopic sight are stably mounted in the telescopic sight, so that destabilizing of the aiming line or of the aiming point cannot occur.

[0017] It has been found to be advantageous to provide an inclination sensor emitting an electrical signal. This signal is supplied to a control device that is in signal connection with the indicator. A cant can be very accurately sensed by such an inclination indicator, and thus even very small cant angles α can be indicated to the marksman. Electrical inclination sensors are also obtainable which require only very little constructional space and operate independently of temperature and shock.

[0018] A control device makes it possible to provide different limits for permissible cants. It has been found to be advantageous to provide a control device into which data can also be read in via an interface, preferably a watertight infrared interface.

[0019] It has furthermore been found to be advantageous to provide as the lighting element a diode that requires little electrical energy.

[0020] It has been found to be advantageous to signal the direction and amount of cant to the marksman by the nature of the light, flashing signal and/or colored signal, of the at least one diode or of the one lighting element.

[0021] It has been found to be advantageous to provide an adjusting element by which the brightness of the lighting element, particularly of the LED or indicator, can be adjusted. A rotary ring, push button, preferably two, and a toggle switch have been found to be advantageous adjusting elements. This adjusting element can also be provided for activating the indicator device.

[0022] It has been found to be advantageous to provide a battery compartment so that the inclination sensor and also the lighting element can be supplied with electrical energy by a battery. It has furthermore been found to be advantageous to provide a solar cell, so that the energy supply can be at least partially provided by the solar cell, or the batteries can be recharged by the solar cell.

[0023] In an embodiment, it is provided that the marksman is made aware of a poor energy status of the battery by a predetermined signal, particularly a flickering signal of the indicator.

[0024] As a fastening device, a clamp device has been found to be suitable, without having to provide a counterpart of a fastening device on the system of telescopic sight and fastening device.

[0025] In order to make available to the marksman an unrestricted field of view of the telescopic sight, it has been found to be advantageous to arrange this indicator outside the field of view of the telescopic sight, but within the markman's field of view. It can thereby be attained that the marksman in shooting position can perceive the indication. In particular, an arrangement coaxial with the eyepiece of the telescopic sight has been found to be advantageous.

Brief Description of the Drawings

[0026] Further measures are described according to the invention. The invention is described in detail with reference to embodiments shown in the accompanying Figures.

Fig. 1 shows the system consisting of firearm and telescopic sight.

Fig. 2 shows an eyepiece-side plan view of a telescopic sight with indicator device.

Fig. 3 shows a side view of the eyepiece section of the telescopic sight with indicator device.

Fig. 4 shows an indicator device with plan view.

Fig. 5 shows an indicator device in side view.

Fig. 6 shows an indicator device in spatial representation.

Fig .7 shows an indicator device with a toggle switch as the adjusting element.

Fig. 8 shows an indicator device with press button switch.

Fig. 9 shows an indicator device with a plurality of lighting elements.

Detailed Description of the Invention

[0027] The principal structure of a system consisting of firearm and telescopic sight is first described using Fig. 1.

[0028] In the system shown in Fig. 1, a rifle 3 is shown as the firearm 1, and has a barrel 5. Instead of this, however, a crossbow could also be shown.

[0029] A telescopic sight 7 is fixed to the rifle 3 by means of a fastening 15. This telescopic sight 7 is aligned so that the optical axis 17 of the telescopic sight 7 runs in a basic position parallel or approximately parallel to the barrel 5 of the rifle 3 and is situated in the plane of symmetry of the rifle.

[0030] When mounting the indicator device 22, care must be taken that a deflection with respect to the plane of symmetry of the rifle, also termed the vertical plane 19, from the vertical axis 21 is sensed by the inclination sensor 23. The vertical axis coincides with the direction in which gravitational force is effective. An adjustment can be performed either purely mechanically or also by the input of an offset value.

[0031] Adjustment by the input of an offset value has been found to be particularly convenient, since no special requirements are placed on the mounting of the indicator device. The indicator device 22 is fastened to the system consisting of the telescopic sight 7 and firearm 1. A sight is taken on a reference line arranged parallel to the vertical axis. An element connected to the control device is then actuated, which can be formed as a push button, or the element provided for adjusting the brightness can be used. The sensed deviation of the vertical plane to the vertical axis is thereby given in the control device as an offset value. This offset value is thereafter taken into account in the determination of a cant. It is thereby possible with little expense to adjust the indicator device 22 after mounting on another system consisting of a firearm 1 and telescopic sight 7. A mechanical fine adjustment is thus not necessary with such a system.

[0032] The telescopic sight 7 includes an objective 9 and an eyepiece 11. The telescopic sight is furthermore provided with an adjusting knob 13 for parallax compensation and an adjusting knob 13 for setting a ballistic compensation. The telescopic sight 7 is furthermore provided

with an indicator device 22. This indicator device 22 is arranged coaxially of the eyepiece 11 and is provided for indicating a cant of the rifle 1 with respect to the vertical axis 21, as described in detail hereinafter using Fig, 2.

[0033] As sketched in Fig. 2, the vertical plane 19 is fixed by means of the barrel 5 and the plane of symmetry of the weapon, and runs through the telescopic sight and the rifle. The vertical axis 21 is aligned according to the effective gravitational force. The acute angle included between the vertical axis 21 and the vertical plane is denoted by α. As long as the vertical axis 21 does not coincide with the vertical plane, there is said to be a cant of the rifle. If the rifle is canted, a sighted target, as explained in DE 22 59 913, is hit with a lateral offset. For example, with a target distance of 600 meters and a bullet drop of 3 meters, an hit point deviation of 16 cm in the horizontal direction results when the cant is 3°. The indicator device 22 is provided in order make possible for the marksman a reliable alignment of the weapon 1 without cant.

[0034] Fig. 3 shows a telescopic sight 7 provided with a possible embodiment of an indicator device 22. The indicator device 22 includes an inclination sensor 23 that is arranged in a housing 26 of the indicator device 22. A control device 31 is furthermore arranged in the housing 26 and is in signal connection with an indicator 25. The control device 31 is preferably embodied by a board on which the various components of the control device 31 are arranged and are connected together in signal connection. ROMs and RAMs may be provided.

[0035] A cant of the rifle 3 is signaled to the marksman by this indicator. In this embodiment, a lighting element 43, specifically an LED 45, is provided as the indicator 25, and is arranged outside the field of view of the telescopic sight. However, the indicator 25 is arranged within

the field of view of the marksman, so that the marksman can always see this indicator 25 when sighting.

[0036] Electrical energy is required for operating this indicator device 22, and is provided by means of a battery provided in the housing 26. The battery is arranged in a battery compartment 29 with a cover 28. A solar cell 30 can in addition be provided for providing electrical energy, and can recharge the battery, and the indicator device can directly be operated with the energy provided by the solar cell.

[0037] A fastening device 33 is provided for fastening the indicator device 22 to the telescopic sight 7. This fastening device 33 is formed as a clamping device 35 that includes an elastic strip element as clamp jaws 37. It is possible to fasten the indicator device 22 to different telescopic sights by such a clamping device. Strip elements of different lengths can be used, and fastening of the indicator device 22 to telescopic sights or eyepieces of different diameter can thus be performed. Another kind of clamping device that preferably has plural clamp jaws can of course also be used. Mounting by a positive connection, for example by a screw segment that is, for example, screwed with a thread in the fastening 15, is conceivable and could also be performed at little cost by later turning of a thread on the fastening 15 for mounting of a telescopic sight.

[0038] An actuating element 49 is provided for switching on the indicator device 22. In the embodiment shown in Fig. 3, a rotary ring 51 is provided as the actuating element 49. A toggle switch 55 could alternatively be used, as shown in Fig. 8. On toggling the toggle switch 55 in one direction, the indicator device 22 is switched on, and by further holding the toggle switch 55 the brightness of the lighting element(s) 43 of the indicator is increased. On toggling the toggle switch 55 in the opposite direction, the brightness of the lighting ele-

ment(s) 43 is reduced. With a reduction of the brightness of the lighting element(s) 43 to zero, the indicator device is switched off. A further alternative of an actuating element 49 is shown in Fig. 9. This actuating element 49 consists of two press buttons 53, with the press button nearer the marksman in the mounted state being provided for switching on or for increasing the brightness of the lighting element or of the indicator 25. The press button 53 on the objective side is provided for reducing the brightness and for switching off the indicator device. Separate actuating elements could of course be provided for switching the indicator on and off.

[0039] Plural alternative solutions as the indicator are shown in Figs. 5, 8 and 10. In Fig. 8, a display 47 is provided as the indicator 25. By different representation on the display, the amount and direction of the cant can be indicated to the marksman. Numeral and letter codes can be used for this, for example "3 r" for a cant of 3° to the right. A purely graphic display, for example, by an arrow, is also conceivable.

[0040] In Fig. 10, a plurality of LEDs is provided instead of one LED as the indicator 25. Depending on the detected cant, at most two LEDs are driven, the amount and direction of cant being indicated to the marksman by their lighting up. For the different LEDs, different angular amounts are allocated to a deflection from the vertical axis, both LEDs being driven for a value between the values allocated to two adjacent LEDs.

[0041] Clamping to the fastening device 15 is possible as an alternative to the arrangement of the indicator device coaxial to the eyepiece 11, the indication then preferably being arranged between the telescopic sight 7 and the rifle 3.

[0042] For mounting the indicator device 22 on the system consisting of firearm 1 and telescopic sight 7, or directly on the telescopic sight 7, it must be ensured that the indicator device 22 is

aligned with respect to the vertical plane 19 such that upon a coincidence of the vertical axis 21 with the vertical plane 19, the inclination sensor 23 detects a deflection of the vertical plane 19 of 0° with respect to the vertical axis 21.

[0043] The permissible cants may depend on the weapon used, with a permissible cant having an acceptable deviation from the aiming point sighted on remaining constant, becoming smaller with increasing target distance. A cant of maximum 1° has been found to be an acceptable amount for a still permissible cant, since a weapon can still be held as precisely as this by an experienced marksman. With a target distance of 600 meters, a deviation of the hit point of at most ± 5 cm results.

[0044] Smaller values can of course also be indicated to the marksman as still permissible cant by the indicator device, by corresponding programming of the control device. This is of particular interest when the indicator device is not used together with a freely held firearm.

Reference List

1	weapon
3	rifle
5	barrel
7	telescopic sight
9	objective
11	eyepiece
13	adjusting knob
15	fastening
17	optical axis
18	preferred plane
19	vertical plane
21	vertical axis
22	indicator device
23	inclination sensor
25	indicator
26	housing
27	module
28	battery compartment cover
29	battery compartment
30	solar cell
31	control device
33	fastening device
35	clamping device
37	clamp jaws
39	field of view of the telescopic sight
43	lighting element
45	LED
47	display
49	adjusting element
51	rotary ring
53	press button switch
55	toggle switch